Attachment F – Wastewater Source Descriptions
(5 pages)

WASTEWATER SOURCE DESCRIPTIONS

Columbia Generating Station (CGS)
October 2010

Circulating Cooling Water Blowdown

The main steam condenser and miscellaneous heat exchangers (turbine service water system) are cooled by the non-contact circulating water (CW) system. The recirculating flow is typically about 600,000 gpm. The heat is rejected to the atmosphere by the evaporative process in six (6) mechanical draft cooling towers. The evaporated water and that lost through drift and blowdown is replenished from the Columbia River at an average rate of about 15,000 gpm. Evaporation of the cooling water results in the concentration of dissolved solids. To limit the buildup of dissolved salts, a portion of the cooling water is released to the river as blowdown (to Outfall 001).

Although the blowdown stream is intended to be a relatively constant discharge, several factors can cause variation in the chemical composition of the discharge. The most important factor is the adjustable blowdown rate that determines the concentration factor for dissolved material in the circulating water. Columbia Generating Station (CGS) has typically operated between 5 cycles of concentration (about 3000 gpm blowdown) and 12 cycles of concentration (about 800 gpm blowdown).

The chemical composition of the blowdown is also affected by the circulating water treatment regime. Sulfuric acid is added to help maintain pH. The water is also treated with a polyphosphate blend for corrosion inhibition in mild steel and a phosphonate copolymer (aminomethylene phosphonate or AMPs) that acts as a dispersant to minimize scale formation. Inhibitor AZ8104 is added separately for copper alloy corrosion control. Microbiocidal treatment is provided with additions of sodium hypochlorite and sodium bromide two or three times per week. Upsets in these treatments can result in variations in the amount of plant component material that becomes corroded or eroded into the cooling water. Also, concentrations of dissolved material can increase slightly during biocide treatment because blowdown is terminated for approximately 10 to 24 hours to allow the halogen residual to decay.

Another factor causing short-term increases in metal concentrations in the cooling water is the periodic dewatering and mechanical cleaning of the condenser tubes during maintenance outages. Online cooling tower cleaning to remove silt and organic matter can cause some of the material to become resuspended such that the solids concentration in the blowdown is slightly higher than normal. CW (and blowdown) suspended solids concentrations are also increased during dust storms because the towers act like large air scrubbers. Seasonal increases in makeup water turbidity also result in higher CW suspended solids.

Also affecting the composition of the waste stream at point of entry to the river are the streams that may be introduced into the blowdown line. One of these is processed liquid radwaste which is relatively pure, low conductivity water that is released in batches of about 15,000 gallons at rates of up to 190 gpm. These releases are necessary if the plant storage inventory is full or if the total organic content of the water is too high to be used in the plant. There have been no releases from the liquid radwaste system since September 19, 1998.

Another source of water discharged to the blowdown line is the standby service water system (discussed below). The primary reason for discharging service water is to reduce the concentration of sulfur or chlorides that have the potential to induce corrosion. Other reasons for discharging include the need to perform maintenance on the submerged components in the spray ponds and the need to clean out accumulations of sediment in the ponds. Infrequently, several million gallons of standby service water might be released to the blowdown line or to the CW system over a period of a couple days to two weeks. This water tends to be of lower cycles of concentration than the circulating cooling water.

Periodically the main condenser becomes scaled, reducing plant efficiency to the point that chemical cleaning of the main condenser becomes necessary. Blowdown to the river will be secured and a cleaning agent, Ferroquest™ or equivalent, will be added to the circulating water system. Inhibitor AZ8104 will be added for copper metal corrosion protection. After the treated water has circulated a sufficient time to remove most of the scale (estimated to be one or two hours), sodium hydroxide will be added for pH adjustment. At the completion of the cleaning process, if any permit condition is not met (typically copper), circulating water will be pumped to a storage location using temporary pumps and piping. During this pumping process, the concentration of constituents in the circulating water will be reduced by the addition of makeup water from the river. When the circulating water meets all conditions for discharge, blowdown to the river will be initiated. After the condenser cleaning process is completed, the stored water will be treated as necessary to meet discharge requirements. Following achievement of discharge limits, the water will be pumped back to the circulating water basin at Columbia Generating Station. Sediment from the cleaning process will be analyzed and disposed in accordance with our solid waste control plan.

Stormwater and Miscellaneous Wastes

Runoff from the plant building roofs is routed through the stormwater system to a small pond (Outfall 002) located approximately 1500 feet northeast of the plant. Stormwater collected in the bermed area around the Diesel Fuel Polishing Building is collected in a sump and periodically discharged to Outfall 002. Also routed to the pond are several wastewater streams. The most significant non-rainfall sources are the plant water treatment systems. Site potable water is prepared by flocculation and filtration of river water. The mixed media filter is periodically cleaned by backwashing with 15,000-25,000 gallons of potable water. This backwash water is discharged through the storm drain system. A side stream of potable water is provided with additional treatment to produce high purity plant process water. The reverse osmosis unit in this treatment train has a reject stream of about 30 gpm when it is producing water with a feed flow rate of 70 gpm.

It also has continuous 5 gpm flow through monitoring instrumentation. Both of these streams are routed to the pond.

Other sources of water discharges to the pond are the sump in the plant General Services Bldg (GSB) basement and floor drains in the Diesel-Generator Bldg (DGB). The GSB sump collects water from building equipment drains and area floor drains. Examples of water sources directed to the sump include HVAC units, pump and valve leakage, demineralized water storage tank overflows, and floor washings. A level switch activates the sump pump and causes the collected water to be discharged to the stormwater pond. The DGB floor drains are connected directly to the stormwater pipe. Among the few sources of water in the DGB are the diesel engine cooling jackets from which approximately 3,800 gallons of water treated with a nitrite-based corrosion inhibitor are drained about once per year.

The Turbine-Generator Bldg (TGB) has three non-radioactive sumps that are normally directed to radwaste processing. The sumps are receiving points for equipment and floor drains in the TGB. For special system drain downs and flushes, these sumps can be discharged to the stormwater pond. For example, this path has been used during outages to remove CW from the condenser waterboxes. The path has also been used to dewater part of the condenser to make online repairs. There also are small streams in the warm weather months from the air wash units on the fresh air intakes of the Radwaste and Reactor buildings.

A proposed transformer yard oil collection system would necessitate periodic pumping of collected stormwater and/or deluge testing water to Outfall 002 or the onsite sanitary waste treatment facility (SWTF). The water collected in the underground storage tank would be sampled for total petroleum hydrocarbons to verify compliance with NPDES or EFSEC Resolution limits prior to disposal. In the event of an overflow emergency, the transformer yard oil collection system tank would discharge to ground rather than directly to Outfall 002 or the SWTF.

Operation and testing of the fire protection system is another source of water discharges to the pond. Periodically portions of the system are removed from service for flushing and flow-rate tests. These batches of several thousand gallons may also be routed to the sanitary waste system or directly to the ground depending on the location and system configuration.

Other discharges to ground may include hydrotesting, maintenance, and construction wastewater discharges. Hydrotesting discharges such as system and component testing, maintenance discharges such as drainage, flushing, and wash down activities, and construction discharges such as concrete curing, concrete cutting, including rinsate and etching solutions, and pressure washing activities.

Stormwater runoff from parking lots, support buildings, and other impervious surfaces around CGS are managed by multiple underground injection control (UIC) wells.

Standby Service Water

The standby service water (SW) system removes reactor decay heat during normal shutdown conditions and provides a heat sink for emergency equipment during a plant transient or accident. The SW system is a closed-loop circulating water system that draws cooling water from, and returns heated water to, an onsite reservoir. This reservoir consists of an interconnected pair of concrete basins (or spray ponds) with a total capacity of 12 million gallons. Water lost to evaporation, drift, and discharges is replenished from the river or from the site potable water system. Dissolved constituents in the SW are typically 2½ times river concentrations. Microbiological growth is controlled with periodic batch additions of 50% hydrogen peroxide. The service water is also treated with sodium silicate for corrosion inhibition.

Historically, a sidestream filter was operated during warm weather months (approximately April through October) to remove suspended organic material from the service water. The filter was backwashed at intervals varying from three days to three weeks. The resulting water was discharged to the ground in a shallow depression (Outfall 003) located about 500 feet south of the spray ponds. Each backwash cycle took about 25 to 40 minutes and created 10,000-15,000 gallons of effluent. The sidestream filter was not placed into service during the current permitting cycle.

On an infrequent basis, the SW ponds must be drained down for cleaning or for equipment maintenance. Whether online or during an outage, the water and sediment can be pumped or vacuumed out of the pond and slurried to Outfall 003. As discussed above, the ponds can also be dewatered by direct discharge to the blowdown line (Outfall 001).

Sanitary Waste

Sanitary waste from CGS, WNP-1/4, and the support facilities is piped to a treatment system that uses aeration lagoons and facultative stabilization ponds. This wastewater treatment facility is located about ½ mile southeast of CGS. The treatment facility also receives sanitary waste from the USDOE 400 Area located about 2½ miles south-southwest of CGS. Influent averages about 20,000 gpd with the higher flows being coincident with the biannual CGS maintenance outage. When the stabilization ponds are full, the treated wastewater is discharged to percolation beds. These discharges are made a few times per year in accordance with EFSEC Resolution No. 300.

Chemical Usage

Water treatment additives used in the systems discussed above and in other water systems are summarized in the attached table.

CGS Water Treatment Chemical Consumption

System and Chemical	Frequency	Annual Use (lb/yr)		Description of Use
		Average	Maximum	
Circulating Water/Turbine Service Water				
Sulfuric Acid	Continuous	2,075,000	2,471,000	pH Control
Sodium Hypochlorite	Batch 2-3 times/wk	560,000	700,000	Biocide
Sodium Bromide	Batch 2-3 times/wk	225,000	269,000	Biocide
AMPs Copolymer & Polyphosphate Blend (DVS3A002)	Continuous	355,000	450,000	Dispersant and Corrosion Control
Inhibitor AZ8104	Continuous	19,200	19,500	Corrosion Control
Ferroquest™	Periodic	As needed	140,000	Condenser Cleaning
Sodium Hydroxide	Periodic	As needed	13,000	pH control following chemical cleaning
Standby Service Water				
Hydrogen Peroxide (50%)	Batch - seasonal	250,000	271,000	Biocide
N Sodium Silicate	Batch	42,000	58,000	Corrosion Control
Potable Water				
Sodium Hypochlorite (12%)	Semi-continuous	8,000	8,000	Disinfectant
Poly Aluminum Chloride	Continuous	4,400	4,500	Coagulant Aid
Polymer	Continuous	8	9	Filter Aid
Demineralized Water				
Amino Acid F	Semi continuous	75	80	Silica Analyzer Reagent
Citric Acid/Surfactant Reagent	Semi continuous	80	85	Silica Analyzer Reagent
Molybdate 3 Reagent	Semi continuous	100	100	Silica Analyzer Reagent
Silica Standard Solution	Semi continuous	75	80	Silica Analyzer Reagent
Closed Cooling Loops				
Nalco 39M	Batch as required	500	600	Corrosion Inhibition- Diesel Jacket Water
Sodium Nitrite	Batch as required	As needed	As needed	Corrosion Inhibition – HVAC Chiller & Heater Systems
Sodium Hydroxide	Batch as required	As needed	As needed	pH Control – HVAC Chiller & Heater Systems
Standby Liquid Control				
Borax	Batch as required	300	400	Reactivity Control (Backup)
Boric Acid	Batch as required	300	400	Reactivity Control (Backup)